CITY OF JOHN DAY

MEMORANDUM

TO:	JOHN DAY CITY COUNCIL
FROM:	NICHOLAS GREEN, CITY MANAGER
SUBJECT:	WASTE WATER TREATMENT FACILITY – PROGRESS UPDATE
DATE:	AUGUST 23, 2016
CC:	TODD HESSE, DEQ

EXECUTIVE SUMMARY

This memo provides background information on the City of John Day's existing waste water treatment facility (WWTF) and progress on upgrading to a new WWTF.

BACKGROUND

Construction of the City's original wastewater collection system began in 1949. Major additions were completed in 1970 and 1978. Since 1978 the system has been expanded several times to support the City's needs and to keep the facility in operating condition.

The existing WWTF is located on the northwestern end of the City at the end of 7th street. It consists of a mechanical plant including influent lift station, headworks structure, two (2) primary clarifiers, two (2) trickling filters, one (1) secondary clarifier, gas chlorination and a chlorine contact basin. Following treatment, secondary effluent flows by gravity to four (4) percolation ponds for disposal. The ponds are located on the north side of the John Day River, with approximately 80 feet of separation. The dry weather design flow of the current facility is 0.6 million gallons per day (MGD).

The City of John Day contracted with Anderson Perry & Associates in 2008 to develop a new Wastewater Facilities Plan to evaluate the existing wastewater treatment facilities, potential improvements, and means of financing an improvements project. On August 26th, 2008, the City Council moved to construct a new WWTF at the site of the existing plant after reviewing the results of the study.

As reported by Anderson Perry, the average daily flow at the facility from 2001-2008 was 0.240 MGD, with a maximum daily flow of 0.840 MGD on May 20th, 2008, and a minimum daily flow of 0.115 MGD on September 25th, 2005. In the eight years since that study, the average daily flow has decreased slightly to 0.232 MGD, with peak flows occurring during the flooding of May 2011 at 1.79 MGD.

The year 2011 total estimated cost for the project proposed by Anderson Perry and adopted by the Council was $8.29M. The Plan called for construction of a new activated sludge treatment facility with continued discharge into the existing percolation ponds. This proposal necessitated increasing the level of treatment needed to meet current and future permitting requirements and included a new lift station; new activated sludge treatment process; a new UV light disinfection system; two (2) aerobic digesters for sludge treatment; new yard and process piping including a

grit removal system; new electrical, instrumentation, and controls; a new operations building and blower/generator/electrical building; and associated demolition, site work and landscaping.

CURRENT STATUS

Several assumptions made in the 2008 Plan may no longer apply, including the projected population growth, technological advances since 2008, the continued dependence on percolation ponds for the effluent, the exclusion of a lagoon-based option, and the projected costs of the facility.

The estimated population of John Day in 2008 was 1,845 residents. From 1960 to 2008, the population fluctuated from a low of 1,520 residents in 1960 to a high of 2,012 in 1980. As the City currently treats wastewater from Canyon City, their population statistics were also included in the Plan. Canyon city's population in July 2008 was estimated at 675 residents, up from its 1970 low of 600 residents. At a 2% projected population growth rate, the combined population of both cities in 2030 was estimated to be 3,819 people. However, the real population statistics for John Day show the city's population has declined by 16.5 percent (-0.48% annually) from its 1980 peak to its present population of 1,680. Based on these data, it is unlikely that this area will reach the 2030 population projection. The City needs to address the possibility that without aggressive intervention, the City's population may continue to decline and its economy continue to stagnate well into the future.

Given these considerations, the Plan should be revised to include a treatment approach that is scalable. This would require a facility design that is based on the city's current population and utilization rates, but which has the ability to be expanded and scaled to allow for future growth. This is especially important as the Canyon City Council has publicly stated their intent to pursue their own wastewater treatment solution in the future. Were this to take place, the volume of influent treated by the new WWTF would decrease by approximately 15 percent.

Emerging technology since 2008 also warrants an update to the Plan. New WWTF options include systems that use hydroponically grown greenery for secondary treatment of effluent. Cost-benefit analysis has shown these types of systems may have a higher societal net present benefit than conventional activated sludge facilities.[1] Hydroponics WWTFs are currently in use in both Europe and the United States. The most recent example is the WaterHub system in Atlanta, GA, which uses hydroponically grown plants to recycle up to 400,000 gallons of water per day. This type of solution could be scaled to meet future demand, would create a renewable asset in the form of reclaimed water for land-application, and could be coupled with a controlled environment agriculture (CEA) industry using ancillary greenhouses to grow cash crops for export.

Finally, the volume of reclaimed effluent may warrant reconsideration of a lagoon-based system to store excess effluent that may not be immediately usable. For example, some winter effluent could be stored for use over the summer if the hydroponic system can't beneficially use all of the reclaimed water year round.

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[1] E. Schrammel, *A Cost Benefit Analysis of Hydroponic wastewater treatment in Sweden,* Uppsala 2014.

Given the scale of the proposed investment for a new WWTF, it is in the best interests of the City to evaluate the technical feasibility, costs and benefits of a hydroponics WWTF option, while concurrently updating the planning assumptions and costs associated with the option selected in the 2008 Plan.

HYDROPONIC WWTF CONCEPTUAL FRAMEWORK

A commercial-scale water reclamation and reuse system harvests water directly from the City's sewer system and "utilizes co-engineered processes to treat the wastewater for beneficial reuse."[2] The WaterHub system in Atlanta (Figure 1) reclaims up to two-thirds of the treatment area's wastewater for commercial and industrial use, and also provides a state-of-the-art research facility for hydroponic horticulture.

Figure 1. Emory University's WaterHub, a production-scale greenhouse used to hydroponically treat wastewater effluent

A similar system in John Day could produce reclaimed water for a variety of uses, including CEA, irrigation and landscaping, and utility operations. It also has the potential to create economic value by scaling the greenhouses used for effluent treatment to grow cash crops for manufacturing and export. These crops could include bamboo, flowers, lavender, ornamental grasses, medicinal herbs, and processed plant derivatives for personal hygiene products, clothing and textiles, and essential oils.

A diagram of the hydroponics WWTF conceptual framework is shown in Figure 2. This framework rests on three integrated pillars that support the overall framework: 1) Wastewater reclamation; 2) Controlled environment agriculture; and 3) Renewable energy resources.

Wastewater reclamation. Wastewater reclamation is accomplished through the treatment process. The WaterHub treatment facility uses an 11-stage process that includes a rotary screen, anoxic moving bed bioreactors, aerobic moving bed bioreactors, hydroponic reactors, a clarifier tank, disk filter, ultraviolet disinfection, a 50,000 gallon storage tank for reclaimed water,

[2] http://sustainablewater.com/why-reuse-water/

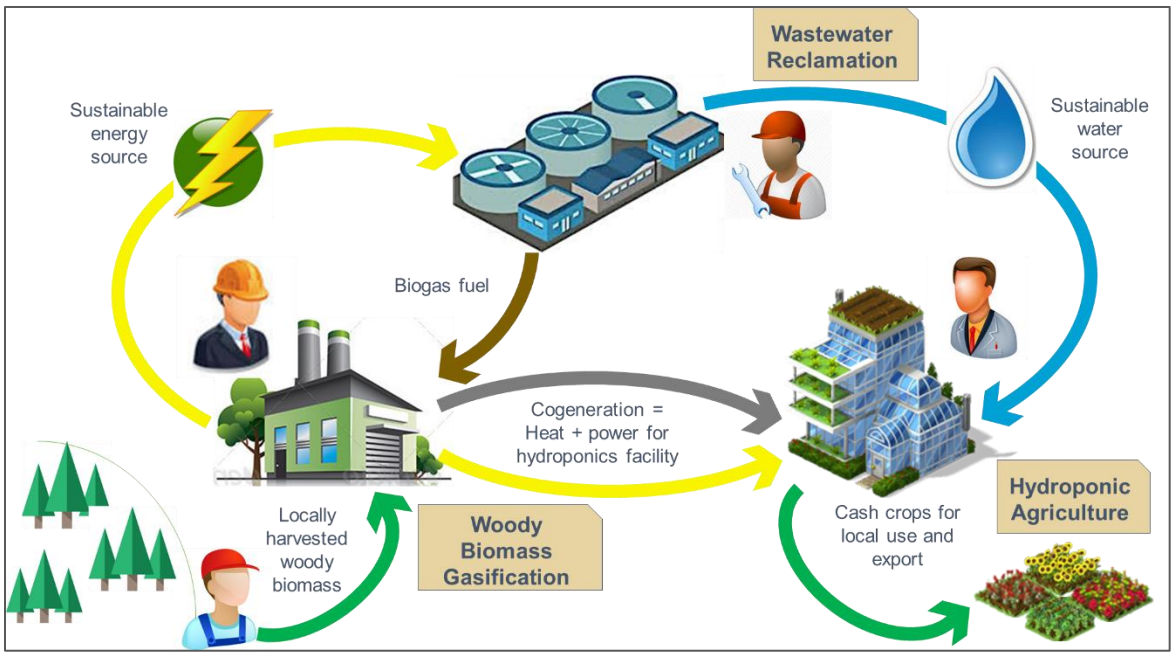

Figure 2. Conceptual Framework for a Hydroponics Wastewater Treatment Facility in John Day, OR

and an end-stage distribution system to transfer the reclaimed water. John Day would need to explore a range of preliminary design options in order to select a treatment process tailored to the city's needs and unique circumstances should the Facility Plan level analysis indicate this is a viable wastewater treatment option. Alternatively, the City can explore privatizing this portion of the system through a long-term water repurchasing agreement with Sustainable Water, the company that designed and financed the WaterHub facility. Sustainable Water designs, builds, operates, maintains and finances the facility in exchange for a 40-year water repurchasing agreement. City Manager Green has contacted Sustainable Water to determine if this is a viable option for John Day.

Controlled Environment Agriculture. Water from the treatment facility is fed into the CEA greenhouses where cash crops are cultivated hydroponically for local use and export. This portion of the system could be managed as a public enterprise, a private enterprise, or as a public private partnership (P3) between the City, a state university, and private growers. It could also include both crop growth and subsequent processing (i.e. processing flowers into essential oils) such that the exports are manufactured goods. The most viable approach for this phase of the process may be to use the "test-validate-scale" methodology, where a test facility (apx. 2500 sq. ft.) is used to experiment with various growth parameters and crop types, the "validate" facilities (apx. 10,000 square feet) are pilot-scale greenhouses that are used to grow the most promising crops, and the "scale" facilities (>10,000 sq. ft) are used for industrial-scale agricultural production of the crops that produce the highest economic value. A cost-benefit analysis may be needed to determine the highest benefit applications for the reclaimed water.

Renewable Energy Resources. Biomass removal efforts from the Malheur National Forest Stewardship contract could be coupled with the WWTF by utilizing biomass as a renewable energy source. Discussions have also occurred about the use of torrefied biomass as an

advanced biomass fuel that can be used as a direct coal replacement in power plants or industrial facilities like the WWTF, with a future facility proposed in or near John Day or Prairie City.[3] Other renewable energy resources that could be explored include fats, oils and grease (FOG) for biogas as well as solar arrays.

ECONOMIC BENEFITS

A new WWTF that takes advantage of economies of scale and forward-looking design innovations has the potential to create new jobs and an entirely new industry in John Day, while simultaneously bolstering existing industries. This would create multi-dimensional economic benefits. The City could also be eligible for multiple low interest loans and grants related to Rural Business Services, including Rural Business Enterprise Grants (RBEG), Rural Business Opportunity Grants (RBOG), the Renewable Energy for America Program (REAP), as well as Rural Economic Development Loans (REDL) and Rural Economic Development Grants (REDG).[4]

Additionally, as cash crops are harvested and sold as exports, the revenue generated from those crops can be used to further offset the operations and maintenance costs of the facility, as a revenue source for future capital improvements, or to reduce the annual sewer rates charged to residents.

PROJECT FINANCING

The 2008 Plan included a range of cost scenarios for the proposed $8.29M facility. Based on the Plan, if the City were to fund the new facility without any grants and without Canyon City contributing any funds to the project, monthly sewer rates would need to be raised to approximately $64-68. Were the City to finance the project through property tax increases under the same set of assumptions, the City would need to raise taxes to approximately $5.50 to $8 per $1,000 assessed value. A new set of cost assumptions based on the hydroponics facility design will need to be analyzed.

The City would also benefit from conducting its own population and income survey of residents. The 2014 American Community Survey (ACS) population estimate for John Day was 1,663 residents, with a median household income of $32,614. The median income for the state was $50,521 for the same period. Census data are often overestimated and are frequently computed for small communities. By conducting its own survey, the City may become eligible for better financing options.

The main utility funding agencies in the state of Oregon are:

- US Department of Agriculture's Rural Development Program (USDA RD)
- Oregon Business Development Department's Infrastructure Finance Authority (IFA)

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[3] Oregon Torrefaction, LLC Request for Proposals, 2016. See also www.oregontorrefaction.com/torrefaction.html
[4] USDA Rural Business Services website, 2016.

- Oregon Department of Environmental Quality's Clean Water State Revolving Loan (CWSRF)

The Rural Community Assistance Corporation (RCAC) also offers funding, but is not as significant a source of funding as the above programs. BPA Energy Smart Industrial (ESI) program also offers varying levels of assistance based on the power consumption of the utility.

REGULATORY ENVIRONMENT

WPCF vs. NPDES Permits. The current WWTF was covered under an industrial Water Pollution Control Facilities (WPCF) permit from the State of Oregon that expired in 2007. The facility is currently under Administrative Review by the Oregon Department of Environment Quality (DEQ). Although the current WWTF is effecting sufficient treatment now to meet permit limits, the facility is approaching the end of its useful life; and due to the proximity of the percolation ponds to the John Day River, continued coverage under a WPCF for the existing facility may not be possible. This would require the facility to be covered by a National Pollutant Discharge Elimination System (NPDES) permit issued by DEQ.

The location of the existing percolation ponds right next to a receiving water means an almost certain subsurface hydrologic connection that would be more appropriately permitted with an NPDES permit. While there is ample area for land application outside of the John Day River Valley, transporting the effluent would mean high pumping costs to get it over the ridge and out of the valley.

Discharge of the treated effluent can generally either go to the river (NPDES permit) or land application (WPCF permit). Due to the nature of NDPES permits and the potential for increasingly stringent permit effluent limits, land application may be advantageous (i.e. less resource requirements) relative to discharge to a receiving water. The proposed hydroponics facility would likely meet the WPCF permit requirements and would enable the City to transition away from discharge to the river by using the reclaimed water in a CEA environment or for other land application uses. Exhibit 1 provides a summary of water reuse requirements for Oregon.

Floodplain Building Restrictions. Goal 7 of Oregon's Department of Land Conservation and Development (DLCD) states "*Local governments shall adopt comprehensive plans (inventories, policies and implementing measures) to reduce risk to people and property from natural hazards. 2. Natural hazards for purposes of this goal are: floods (coastal and riverine), landslides, earthquakes and related hazards, tsunamis, coastal erosion, and wildfires. Local governments may identify and plan for other natural hazards."*

While this doesn't specifically preclude wastewater storage lagoons in a 100-year flood plain, it clearly discourages locating structures in areas that are prone to flood damage. The additional consideration of stored wastewater makes storage lagoons in flood plain a public health issue as well. Any future designs for the WWTF and storage for reclaimed water will have to take floodplain mitigation and compliance into consideration.

The site of the existing WWTF occupies 22.5 acres of land on tax lots 101, 200, and 2500, of 13S31E22D; and lots 700 and 1402 of 13S31E23CB. There is also a 50-acre parcel adjacent to

the City-owned property that is zoned industrial and could potentially be leased to the City for the new facility, however, tax lot 300 is in the county General Industrial Zone and the John Day Urban Growth Boundary and would require development approval through Grant County (see Exhibit 2 for floodplain maps).

NEXT STEPS

The City should proceed on two fronts: 1) developing a preferred alternative for a WWTF project; and 2) investigating project financing options.

- Because the 2008 Plan did not develop the hydroponics option or look at the lagoon alternative for storage of reclaimed water, these elements will need to be added as an addendum to the Plan, along with updated cost projections on the 2008 facility options.

- A Literature Review and Income / Population survey may be needed to ensure the City is using the most accurate data for the design options and financing.

- City Manager Green will coordinate with DEQ, Sustainable Water, Anderson Perry and other stakeholders to develop a project scope and timeline for the Council.

SUMMARY

The City of John Day has a unique opportunity to make a capital improvement that will set a new standard for renewable and sustainable innovation in the state of Oregon. The proposal has the potential to create a new industry in John Day along with associated job growth, while simultaneously off-setting the costs to finance, operate and maintain a new WWTF. Given these potential benefits, an update to the 2008 Plan is warranted before the City proceeds with this capital investment.

Exhibit 1. Summary of Water Reuse Requirements for Oregon State

The following table summarizes key requirements of Oregon Administrative Rules (OARs) Division 55 Recycled Water Use.[5] Not all requirements or information from OARS 55 is contained in the table. For more detailed information on requirements for beneficial use of recycled water please see OARS Division 55 available through footnote reference.

Requirement	Non-disinfected wastewater	Wastewater Class			
		D	C	B	A
Treatment	oxidized	Oxidized & disinfected	Oxidized & disinfected	Oxidized & disinfected	Oxidized, filtered & disinfected
Criteria	none	must not exceed a 30-day log mean of 126 E. coli organisms per 100 milliliters and 406 E. coli organisms per 100 milliliters in any single sample	must not exceed a median of 23 total coliform organisms per 100 milliliters, based on results of the last seven days that analyses have been completed, and 240 total coliform organisms per 100 milliliters in any two consecutive samples	must not exceed a median of 2.2 total coliform organisms per 100 milliliters, based on results of the last seven days that analyses have been completed, and 23 total coliform organisms per 100 milliliters in any single sample	must not exceed a median of 2.2 total coliform organisms per 100 milliliters, based on results of the last seven days that analyses have been completed, and 23 total coliform organisms per 100 milliliters in any single sample. ***Turbidity limits not provided here.***
Crops[1]	Fodder for animals, timber	Firewood, ornamental nursery stock, Christmas trees, sod, pasture for animals	Processed food crops, vineyards is wastewater applied directly to soil, landscaping,	Crops as allowed for class C, some non-crop uses allowed	any agricultural or horticultural use

[5] (http://arcweb.sos.state.or.us/pages/rules/oars_300/oar_340/340_055.html)

Monitoring	Per permit requirements, not specified in OARS	Monitoring for E. coli organisms must occur once per week at a minimum	Monitoring for E. coli organisms must occur once per week at a minimum	Monitoring for total coliform organisms must occur three times per week at a minimum	Monitoring for total coliform organisms must occur once per day at a minimum. Hourly monitoring for turbidity.
Setback[2] (distances are the minimum requirement)	150 feet between irrigation and human water supply source, setbacks for public health and environment defined in permit	100 feet between irrigation and property line for sprinklers 100 feet between irrigation and human water supply source	70 feet between irrigation and property line for sprinklers 100 feet between irrigation and human water supply source	50 feet between irrigation and property line for sprinklers 10 feet between irrigation and human water supply source	Setback distances for food prep or drinking fountains only (no contact allowed)
Access	Public access must be prevented	Milk producing animals may not come in contact with wastewater Personnel at use area must be notified of the type of irrigation water	Landscape irrigation must prevent public from contacting wastewater Public notice required when using for agricultural purposes and sprinklers used	Personnel and public notice required when using for agricultural purposes and sprinklers used Pubic must be restricted from direct contact with wastewater	Personnel and public notice required when using for agricultural purposes and sprinklers used
Management (signage required for some uses, this does not include crops on private property)	Irrigation with recycled water is prohibited for 30 days before harvesting. Sprinkler irrigation is prohibited unless adequate	No irrigation 3 days before harvesting crops	No irrigation 3 days before harvesting processed food crops Edible portion of orchard or vineyard crops cannot contact the ground	No irrigation 3 days before harvesting processed food crops Edible portion of orchard or vineyard crops cannot contact the ground	No requirements / restrictions for crop use on private property

	protection from aerosols.				

1 – Crops that are allowed for irrigation include examples under each wastewater classification and those for lower wastewater classes, e.g. crops that can be irrigated with class B wastewater include examples specific to class B above as well as non-disinfected, class D and class C.

2 – Not all setback requirements are included. For example class D wastewater applied with sprinklers must be 70 feet or more from areas of food preparation. This type of setback is not expected to apply to application on crops. Where an irrigation method is used to apply class C or lower recycled water directly to the soil, there must be a minimum of 10 feet from the edge of the site used for irrigation and the site property line, no setback requirements for class B or higher when applied directly to the soil.

Exhibit 2. Floodplain Map of City and Adjacent Property for new WWTF

City Property (Orange) and adjacent land (Purple); 100-year floodplain is in Yellow.